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GAS ABSTRACTS

GAS ABSTRACTS represents the inauguration of a new phase of service to the Gas Industry by the Institute of Gas Technology, the dissemination of information. GAS ABSTRACTS, which is published monthly, consists of abstracts of papers appearing in current technical journals in the field of gas technology and related subjects.

Scope of Selection: Articles, papers, and books, both theoretical and applied, pertaining to the manufacture, distribution or utilization of natural and manufactured gas will be considered. The periodicals listed on the last two pages will be read regularly. For the time being, only abstracts of those articles which are of immediate interest to our own staff, with a consideration of the interests of research and development men in the industry as a whole, will be considered.

Method of Abstracting: For the most part, the abstracting is done by the research staff of the Institute of Gas Technology. It is intended, in general, that the abstracts supply the technical man with sufficient information about the data contained in the paper to enable him to determine the desirability of reading the entire paper. For some articles which seem of unusual value a more detailed summary will be made.

Classification of Abstracts: The abstracts are grouped together in twelve subject groups and are arranged alphabetically by subject in each group. These subject groups and pages on which the abstracts appear are listed in the Table of Contents.

Format: The publication is prepared in such a manner that the abstracts can be cut and pasted on 5x8 cards for filing. We have considered publishing the abstracts in card form but for the present are unable to do so because of the added time and expense involved.

Annual Index: The preparation of such an index is being considered.

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1. THE GAS INDUSTRY

ECONOMICS

Segeler, C. G. ECONOMICS OF LP-GAS OPERATION. *Am. Gas Assoc. Monthly* 27, *434-440, 1945 (October).*

This is a very comprehensive and timely study of operating details of 16 LP-gas companies compared with a selected group of 30 similiar small gas companies located near the LP-gas companies. The sizes of the LP-gas companies ranged from 301 meters with an annual production of 13,675 MCF to 5256 meters and an annual production of 202,131 MCF. Of these 16 companies 13 are on the basis of 530 Btu gas. The three other companies distribute 1000 Btu gas to 4187 meters. The sizes of the manufactured gas companies ranged from 542 meters with an annual production of 18,984 MCF to 3255 meters and 184,997 MCF.

Tables are included showing data on sales, revenue, operating costs, employees, customers per mile of main, Loss and unaccounted for gas and financial ratios all of which bear out the contention that LP gas companies can and are being operated on a profitable basis. Operators of small manufactured gas companies should read this excellent article.

--L.J. Willien

GERMAN INDUSTRY

DEVELOPMENTS IN THE GERMAN CHEMICAL INDUSTRY. *Chem. Eng. News* 23, *1516-1522, 1945 (September 10); Chem. Met. Eng.* 52, *115, 188-206, 1945 (September); 192-208, 1945 (October).*

The first part of a report on the findings of the civilian investigators who studied German chemical industry for the Chemical Warfare Service. The following headings are covered in the report: Chemicals from Water, Air, and Coal through Hydrogen; Acetylene Production and Utilization; Surface Active Chemicals; Tanning Agents; Polymers; Electrochemicals; Rocket Propulsion Chemicals; Oxidation Products, Chlorination Products; Lubricant and Fuel Additives; Substitutes; Insecticides, Insect Repellents, and Rodenticides; Pulp and Paper; Pharmaceuticals; and Miscellaneous.

--G. D. Creelman

Editors Note: Other articles on this subject are: Plastics Development in Germany, *Chem. Eng. News* 23, *1615, 1945 (September 25);* The German Synthetic Rubber Industry, *Chem. Eng. News* 23, *1627;* German Chlorine, a Report on Production Methods, *Chem. Met. Eng.* 52, *104-100, 1945 (October);* Acetylene Industry in Wartime Germany, *Chem. Met. Eng.* 52, *116-119, 1945 (October).*

HEATING

Boyer, E. G. THE UTILIZATION OF HYDROCARBON GASES IN THE PRODUCTION AND DISTRIBUTION OF MANUFACTURED GAS. *Am. Gas J.* 163, *21-30, 1945 (October).*

Public interest in gas house-heating has seldom been so keen as at the present time. To profit by this situation, the gas industry must solve three problems: 1- It must produce gas more cheaply, 2- It must provide

peak production capacity with the minimum of investment per MCF. 3- It must minimize the cost of distributing its gas.

Experience of the Gas Department of the Philadelphia Electric Company over the last 15 years has gone a long ways toward solving the first two of the problems and it is pointed out how others, it is believed, can duplicate their results to a degree by using LP gases in place of the refinery oil gas they used. The refinery oil gas process used is the result of nearly 20 years experimentation and development. It has increased the combined capacity of 4-9' x 10' x 10' mechanical generator carburetted water gas sets and 1-10' OD hand clinkered set from 27,000 MCF per day to 46,000 MCF: an increase of 70%. A comprehensive description of the development of the process since 1930 is given. Butane was used for a short time instead of refinery oil gas.

--L.J. Willien

HEATING - ECONOMICS

Henry, H. M. ECONOMICS OF GAS HOUSE HEATING. *Am. Gas Assoc. Monthly* 27, *155-158 (April); 215-222 (May); 267-276 (June); 327-340 (July), 1945.*

This is a thorough study of fundamental factors to be considered, by a manufactured gas company, when analyzing the house heating load and data on the selection of the most economical gas production methods for supplying it. A simple formula was developed for determining the overall unit cost per MCF of making gas for different load factor conditions. This formula enables a quick determination of that "load factor" at which one gas process is more economical than another. The formula is applied to a few typical gas companies to show the application of the fundamental factors to actual company conditions.

--L.J. Willien

HEATING - ECONOMICS

Henry, H. M., PRODUCTION, DISTRIBUTION AND SALES OF GAS FOR HEATING. *Gas Age* 96, *34, 1945 (September 20).*

The author discusses the post-war gas house heating load from the standpoint of production, distribution and sales. As a means of meeting the required increase in gas production he offers for consideration the following alternatives: 1. LP-gas - air installations, 2. The use of LP-gases in generators and for cold enrichment. 3. Installation of catalytic cracking plants for reforming natural gas, or the LP-gases. 4. Various methods of increasing output of old plants. 5. Larger and more efficient new gas plant equipment. He discusses economic and practical problems arising from the additional loads on distribution systems, and recommends independent distribution studies by several large utility companies as the best means of solving these. Prospects for post-war house-heating business are regarded as bright, but it is suggested that heating sales will remain substantially proportional to heating sales effort.

--M.F. Knoy

I. THE GAS INDUSTRY

HEATING - ECONOMICS

Howie, G. G. PRODUCTION COST OF GAS FOR HOUSE HEATING. *Gas Age* 96, 30-31, *1945 (October 4).*

This is a study covering both production and investment costs for the Cambridge Gas Light Company. When there is a house heating saturation of 14.4%, a comparison is made of using propane-air gas for peak load with water gas. The selection of a certain amount of propane-air gas for peak blocks with water gas for the base load would save $112,000 annually in combined production and carrying charges over the situation that would develop if they continued to take care of all the increasing load of base load blocks and peak blocks with additional water gas producing equipment. The study, which is based upon present-day prices for additional plant and materials used, merely points out the necessity for, and the benefit of, further study in regard to types of plant and processes for production of the gas which will be needed as a house heating load is acquired.

--L.J. Willien

RESEARCH

NEED FOR FURTHER GAS RESEARCH EMPHASIZED. *Oil Weekly* 110, 33, *1945 (October 1).*

The economic importance of natural gas has grown rapidly in recent years. There has been an almost complete lack of research on natural gas problems. There is a need for much fundamental information, not only on the utilization of gas, but also on production and transportation problems. Several companies have inaugurated natural gas research studies or have indicated their intention of doing so. However, there is such a vast amount of fundamental research to be done that studies by groups like the Bureau of Mines are advisable.

--Excerpt from article.

RESEARCH

WILSON, COLEMAN SAY INDUSTRY CAN MEET PREDICTED INCREASE IN OIL DEMANDS, URGE FREEDOM OF TECHNOLOGICAL RESEARCH. *Natl. Pet. News* 37, 19-30, *1945 (October 10).*

Washington- The Senate petroleum resources committee was told last week that the next 20 years is expected to see a 40% increase in demands for petroleum products in the United States and more than a 100% increase in demands of foreign countries. The committee was also told that the basic answer to future oil needs lies in technology and free enterprise rather than the new high total of more than 20 billion bbls. of proven reserves in the ground. Stewart P. Coleman, director of the co-ordination and economic department of the Standard Oil Co. (New Jersey), and Dr. Robert E. Wilson, president of Standard Oil Co. of Indiana, were the two men called to testify before the investigating committee. The testimony of both Mr. Coleman and Dr. Wilson is carried in full in this issue of NPN. Mr. Coleman, in his testimony, pointed out that a more-than-adequate supply to meet consumption can be taken for granted, since actual and potential supplies in foreign areas (which contain approximately two-thirds of the world's crude oil reserves) exceed greatly future

consumption estimates.

The number of oil burners in use is expected to increase from 2,243,000 in 1941 to 4,800,000 in 1965, with each burner using 43 bbls. of oil per year in 1965 compared with 56.8 bbls. in 1941, as a result of improvements in efficiency of homes and home-heating equipment.

--Excerpt from article

RESEARCH

Gaylor, P. J. WHITHER INDUSTRIAL RESEARCH? *Natl. Pet. News* 37, 802-803, 1945 *(October 3)*.

Extrapolating industrial research expenditures indicates a logarithmic increase at a rate which doubles every five years. Statistics of patents issued to companies shows that for 1941-1943 only 166 obtained ten or more patents per year and only 14 obtained 100 or more per year.

--G.D. Creelman

RESEARCH

Thomson, D. L. UNIVERSITIES AND RESEARCH. *Can. Chem. & Process Ind.* 29, 614-615, 1945 *(September)*.

Universities play a dual role in fundamental research and in training technical personnel-Government and industrial support needed.

RESEARCH

Young, W., HAS RESEARCH "PAID" IN THE GAS INDUSTRY? *Gas Times* 44, 1-5, 1945 *(September 22)*.

"The industry is entrusted by the community with the responsibility of supplying an even better gas service at the lowest possible cost. This can only be got by

(1) Better administration. (2) Improved technical personnel through better opportunities for education and experience. (3) The provision of the fullest justifiable organization for research."

--Excerpt from article

RESEARCH, GOVERNMENT

SCIENTIFIC INFORMATION FROM GOVERNMENT-SPONSORED RESEARCH AND ENEMY SOURCES BEING RELEASED. *Chem. Eng. News* 23, 1720-1724, 1945 *(October 10)*.

"Enemy scientific and industrial information" has now an official releasing body, Office of the Publication Board, under the Department of Commerce. When the informational material is released for publication the matter is to be placed on microfilm or printed. When a release date arrives the publication is to be announced by descriptive title, abstracted and indexed. No decision has yet been reached about charging for this service.

I. THE GAS INDUSTRY

Up until this time only 383 reports have been "declassified" "some of the reports in this list carry very little technical or otherwise information... a number of them are very well done and contain worthwhile economic and technical data."

The main groupings under which these documents fall are: Aircraft, Chemical Warfare, Chemicals, Pharmaceuticals, Plastics, Films, General, Jet Propulsion, Rockets, Bombs, Instruments and Devices, Machinery and Equipment, Medicine, Metallurgy, Petroleum, Radar, Radio, Electionics, Telephone, Rubber, Vehicles, Wood, Pulp, Paper, X-ray.

STORAGE PLANT

McCarthy, E. R. SCIENTISTS COMPLETE STUDY OF FAILURE OF EAST OHIO GAS COMPANY'S LIQUID STORAGE PLANT. *Natl. Petroleum News, Tech. Sec.* 37, R-679, *1945 (September 5).*

UTILITIES

Miller, B. SHOULD GAS AND ELECTRIC UTILITY SERVICES BE COMMONLY CONTROLLED? *Gas Age* 96, 60-61, *1945 (October 18).*

The author believes that common control of gas and electric utilities would effect economics in production, distribution, and utilization, without doing away with the benefits of competition.

2. APPLIANCES

BURNERS

METAL DISC BURNER FOR IDEAL RANGE. *Butane Propane News* 7, 72-77, *1945 (October).*

This article includes a summary of suggestions, made by women employees of Pacific Coast Gas Association member companies, for features of the ideal gas range. It also tells what has been done to approach this ideal especially in respect to top arrangement and burner grate assembly. A new feature is a metal disc burner which directly supports and imparts heat to the cooking vessel.

--S. Dean

COOKING - COMMERCIAL

McNair, J. W. COMMERCIAL COOKING. *Butane Propane News* 7, 43-52, *1945 (October).*

J. W. McNair, manager of the Standard Gas Equipment Corp., manufacturers of commercial ranges, gives the industry a broad view of what the future may hold and information dealers and manufacturers can capitalize upon when soliciting commercial accounts. His remarks, delivered before the Florida-Georgia Gas Meters Association at Daytona Beach are too extended for full publication, but the accompanying abstract features many important points.

--Author's Abstract

STEAM COOKERS

Seelbach, K. L. GAS STEAM COOKER MEETS THE TEST. *Am. Gas Assoc. Monthly* 27, *459-460, 1945 (October).*

A resume is given of experience with a direct steam cooker for restaurant use. Steam is obtained from a gas-fired steam boiler built integral with the cooker and provided with automatic water level and pressure controls. Direct steaming has been found very useful in meeting peak restaurant loads on short notice, due to the short time required for cooking. Vegetables are ready to serve after 15 or 20 minutes and the cooking time for meats, eggs, etc. is correspondingly shortened. Nutrient elements are said to be retained better than for other means of cooking and shrinkage on meats is less.

--M.F. Knoy

3. COAL AND GASIFICATION

COAL - CARBONIZATION

King, J. D., MacDougall, D. and Bardgett, H. THE EFFECT OF FREE SPACE IN THE CARBONIZATION OF COAL IN HORIZONTAL RETORTS. *Gas J.* 246, 259-263, 1945 *(August)*.

Some experiments in the carbonization of British coals are described. The effects of increased temperature and of free space above the coal charge and at the ends are significant. In general the combination of these principles, within certain limits, resulted in a higher thermal yield and overall output. Retort conditions are limited by too severe cracking. Increase of free space over the coal charge was found to have a greater effect on carbonization than did an increase in space at the ends, where the temperature was considerably lower. It was found that increasing the cracking space by 40% increased the thermal yield of gas by 1.5 to 3.5 therms and altered appreciably the composition of the tar produced, but not the net yield of tar.

--L.H. Mc Ewen

COAL - GASIFICATION

GASIFICATION OF COAL WITH HYDROGEN UNDER PRESSURE. *Fifth Annual Report of the British Gas Research Board, pp. 9-13, (1943-44).*

Difficulties experienced as a result of the fusion of the coal when hydrogenated directly at high pressures and temperatures have been overcome by grading the charge in a special way. The individual pieces of coal had to be above a certain minimum size. For the purpose of confirming these results, obtained with a charge 7 in. diameter and 12 in. deep, a larger unit was built on a pilot plant scale. This unit, capable of holding a charge 12 in. in diameter and 8 ft. deep, is described in detail together with the accessory equipment. A flow diagram shows the cylinders for high pressure storage, pressure reducing valve, flow gauge, vaporizer, reaction vessel, condenser, sampling device and meter. Typical results of preliminary experiments on the gasification of semi-coke at 25-50 atm. and 570-635° C showed that about 25% of the semi-coke was gasified, half of this representing the volatile matter in the coke while the remaining half represents carbon reacting directly with hydrogen. Heating values ranging from 403 to 460 Btu per cu. ft. have been obtained. The remarkably high rate of the passage of the reaction zone through the charge from top to bottom, 60-140 in. per hr., is unique in a gasification process. The experiments already indicate that the direct hydrogenation of carbon can be readily initiated and and sufficient exothermic heat is liberated for the transmission of the reaction zone through the charge. The extent of hydrogenation is evidently limited by equilibrium considerations. It is planned to investigate the effect of the addition of steam to the hydrogenating gas, superimposing an endothermic reaction on the hydrogen-carbon reaction.

--J.J. Sebastian

3. COAL AND GASIFICATION

COAL - GASIFICATION

UNDERGROUND GASIFICATION OF COAL. *Petroleum* 8, 146, 1945 (August); *Petroleum* 8, 168, 1945, (September).

The gasification of coal underground, originally suggested by Mendeleyev, is finding increased interest in Russia and Britain. Economic advantages, both in decreased cost of equipment (about 60-70% of normal gas producing plants) and avoidance of underground labor, result in an overall production cost which is between one-quarter and one-third of that of producing gas by the usual methods. Gasification is accomplished by passing air, air and steam, or oxygen and steam mixtures directly into a burning coal seam, and drawing off the make gases thru a separate boring. Daily capacities of 88,000 to 106,000 cu. ft. of 137 Btu gas during blow periods and 42,000 to 53,000 cu. ft. of hydrogen-rich gas during intervals between blows were obtained. The heating value and composition of gas produced depend on the percentage of oxygen in the blast. The amount of CO_2, CO, H_2, and CH_4 increase upon increase in O_2 in the blast. A typical gas analysis using air as blast is: CO_2, 8%; O_2, 0.2%; CO, 12%; H_2, 14%; CH_4, 2.5%; N_2 63.3%; Btu, 108. With 70% oxygen in the blast, the corresponding values are: CO_2, 20%; O_2, 0.2%; CO, 28%; H_2, 30%; CH_4, 10%; N_2, 11.8%; Btu, 286.

--J.J. Sebastian

COKING - BY PRODUCTS

Reed, J. B. RECOVERY OF BY-PRODUCTS IN HIGH TEMPERATURE COKING. *British Coal Util. Research Assoc. Monthly Bulletin* 9, 225-233, 1945 (August).

A brief historical background of the utilization of coal is given and the objects of the carbonization processes are pointed out. The recovery of ammonia, removal of H_2S and HCN, recovery of benzol and phenols, improved techniques for recovery of benzol and sulfur employing pressures above or temperatures below normal, separation of hydrocarbons in coke-oven gas and "reformation" of coke-oven gas are separately reviewed and discussed. A fairly extensive bibliography is included.

--R.L. Husch

GASES - SEPARATION

SEPARATION OF GASES BY REFRIGERATION. *Fifth Annual Report of the British Gas Research Board, pp. 41-42, (1943-4).*

A study was made of the problems concerned in the liquefaction of methane from coal gas from the viewpoints of (a) providing fuel for internal combustion engines; (b) storage for the purpose of re-gasification as an enriching agent for blue water gas at periods of peak demands; and (c) transportation to country districts not provided with gas. During liquefaction, ethylene and propylene, whose value to the chemical industry is high, can be separated as part of the same process. In addition, benzol, water and all organic sulfur compounds are removed during the refrigeration process. The study made consisted of the determination of the percentage condensation of the constitutents at various temperatures down to 195° C and pressures from 1 to 90 atm.

Investigation was also made of methods of removal of benzol and water, and experiments were started for the determination of heat transfer at low temperatures.

--J.J. Sebastian

GASES - UTILIZATION

RESEARCHES ON GAS UTILIZATION. *Fifth Annual Report of the British Gas Research Board, pp. 29-39, (1943-44).*

Survey of Gas Quality at various gas producing plants was started in order to collect information regarding the chemical, physical and combustion characteristics of the gas made, and to ascertain the effects of differences in coals, carbonizing conditions and methods of operation on the properties of the gas. Samples of gas have been taken to determine their Btu, specific gravity, composition and flame characteristics. These will be correlated with the methods of manufacture in order to improve the latter to ensure a product which will give maximum satisfaction to the consumer. Organic Sulfur Compounds in Gases have been determined in order to obtain accurate information as to the principal types of these compounds occurring. The collection of such data was included as part of the survey of gas quality. At works "A", carbonizing Yorkshire coals in horizontal retorts, the straight coal gas was found to contain 22.2 grains of CS_2 out of a total of 37.1 grains of organic sulfur per 100 cu. ft. of gas, the balance being 5.3 grains of volatile sulfur compounds and COS, 7.6 grains of thiophene, and 2.0 grains of mercaptans. In comparison, producer gas made at the same plant was found to contain 12.2 grains of COS out of a total of 13.8 grains of organic sulfur, and blue water gas contained 28.0 grains of COS, 3.1 grains of CS_2 and 2.6 grains of mercaptans, a total of 33.7 grains of organic sulfur per 100 cu. ft. Heating and Drying by Radiation was a subject of continued study, particularly the emission characteristics of typical refractory materials and also of gas-heated sources of radiant energy. It was found that the incorporation of small amounts of colored oxides, such as Fe_2O_3, into the refractory body increased the emission in the shorter wave-length region. When the thermal input is the same, materials of low emissivity attain a higher temperature than does a black body. Refractory materials which may be utilized as high-temperature sources of radiant heat were found to be relatively poor emitters as compared with a black body at the same temperature. Investigation is being continued to find the advantages of radiant heating in the hot molding of thermo-setting plastics, in the high-speed drying of multi-colored printed posters, sterilization of cans, processing of finishes on fabrics, etc.

--J.J. Sebastian

3. COAL AND GASIFICATION

METHANE - SYNTHESIS

SYNTHESIS OF METHANE. *Fifth Annual Report of the British Gas Research Board, pp. 13-25, (1943-44).*

The problem of the synthesis of methane from CO and H_2 by means of promoted nickel catalysts at temperatures from 350° to 800° C and at pressures from 1 to 50 atm. has been investigated separately by the Gas Research Board Laboratories and the Fuel Research Station in Britain. Both laboratories have studied methods to prevent (a) the loss of activity of the catalyst due to overheating, which causes a diminution of active surface (sintering), and (b) deposition of carbon at higher temperatures. Their suggested means of overcoming these difficulties are in fairly close agreement: (1) Catalysts prepared by the precipitation of nitrates with alkali as carbonate in the presence of kieselguhr support, followed by a very thorough washing, are more resistant to heat treatment and give a much lower carbon deposition than those obtained by impregnation, i.e, ignition of the absorbed nitrates on the support. (2) Overheating, or sintering, as well as the rate of carbon deposition, depends on the effective removal of the exothermic heat of reaction and increases with increasing working temperatures. At 700° C the life of the catalyst becomes relatively short. However at 800° C an extremely long life was observed in spite of sintering, probably because at such high temperature the reaction is no longer dependent upon specially active atoms in the catalyst. (3) The rate of carbon deposition depends upon the nature of the support. Catalysts of identical composition supported on kieselguhr from one source gave ten times more carbon deposition than those on kieselguhr from another source. (4) Carbon deposition decreases as the size of the catalyst granules increases. Heat dissipation is also favored by the use of a narrow catalyst space surrounded by a jacket containing a high-boiling liquid. (5) The admixture of steam with the process gas decreases carbon deposition, and 15% steam (by volume) entirely prevents it. (6) The higher the H_2/CO ratio the less the tendency to deposition of carbon. The amount of steam required by gases of various H_2/CO ratio in preventing carbon deposition is shown by curves for various temperatures from 350° to 600° C.

—J.J. Sebastian

ORGANIC SULFUR COMPOUNDS - REMOVAL

REMOVAL OF ORGANIC SULFUR COMPOUNDS FROM GASES. *Fifth Annual Report of The British Gas Research Board, pp. 25-29, (1943-44).*

The removal of organic sulfur compounds from gas mixtures is essential when using catalysts for synthesis or when the gas is sold to industrial and domestic users. A catalyst containing copper and chromium supported on active carbon or alumina was found to be highly active at temperatures as low as 200° - 250° C. On activated alumina at 200° C the organic sulfur in the gas was reduced from 24.8 to 0.89 grain per 100 cu. ft. of gas, a conversion of 96.3%; at 250° C a reduction from 23.0 to 0.27 was obtained with a conversion efficiency of 98.8%. A high space velocity of 2,500 vols./vol./hr. was used with a subsequent catalytic treatment for the complete conversion of all organic sulfur compounds into H_2S. The

3. COAL AND GASIFICATION

latter had to be removed at the temperature of its production. Certain iron ores can be used for this purpose, but at 250° C they allow traces of H_2S to pass. For this reason, the search continues for an oxide of higher activity. Studies have also been made of the nature of the reactions taking place during catalysis. If acetylene is present in the gas treated, it is necessary to pass the gas through a catalyst which rapidly hydrogenates the acetylene, thereby preventing the poisoning effect of this compound. Molybdenum sulfide on alumina support was found to be suitable for this treatment. Development of this work on a larger scale is being actively pursued.

--J.J. Sebastian

PRODUCERS

Smith, W.P. PRODUCER CONTROL. *Gas J.* 246, 294-299, 1945 (August 29).

The economics of producer plants have not received the consideration deserved. On the basis of 14 lb. coke consumed in the producer per 100 lb. coal carbonized, a saving of only 2% of fuel to producers would easily pay for the cost of improving the control of producers. A well balanced producer battery has the following characteristics: (1) Constant absolute pressure in the CO main; (2) Optimum quality of gas produced. The former has been attained without difficulty in normally controlled sets. The latter may be achieved by connecting several producers to a common CO main, clinkering each producer in rotation, and adjustment of CO main pressure to compensate for variations in the quality and size of fuel. A comparison of the economics of the open and closed door type of step grate producer is given, and a discussion is included of control of other producer types such as that of the air-blown step-grate, closed-door step-grate fired by auxiliary gases and the closed-door producer. The control of producers depends largely on the nature of fuel; breeze of ⅜" to 0" size has been successfully gasified. Clinker difficulties may be solved by the slagging producer.

--C.V. Von Fredersdorff

REFRACTORIES

STUDY OF REFRACTORIES. *Fifth Annual Report of the British Gas Research Board, pp. 42-45 (1943-44).*

Work done for the Gas Research Board by the British Refractories Research Association consisted of (1) a study of refractory insulating materials, namely an investigation of the effect of texture on the rate of burning out of combustible clay blocks; (2) examination of nineteen brands of silica and two brands of siliceous brick in order to establish correlation between a tendency to spalling or cracking and other physical properties; (3) study of deformation of refractory materials at high temperatures; and (4) investigation of the action of carbon monoxide on refractory materials. The latter study revealed that ferrous alumino-silicate glasses prepared in the laboratory do not actively catalyze the decomposition of CO into C and CO_2 at 450° C, but that samples previously

reduced by CO and H_2 at 900° C were rendered catalytically active to the reaction $2CO = C+CO_2$, causing disintegration. Oxidizing treatment at 900° C also renders the glasses catalytically active at 450° C.

--J.J. Sebastian

VOLATILES - DETERMINATION

Mott, R. A. and Spooner, C. E. THE VOLATILE MATTER OF LIGNITES AND PER-HYDROUS COALS. *Fuel in Science and Practice* 24, 106-110, 1945 (July-August).

Various methods of determining the volatile contents of lignites and coals rich in resins, waxes or algae have been compared. Several comparative tables are included and discussed. The British Standard Method and the A.S.T.M. modified tests gave checkings and probably correct results. The standard B.S. and A.S.T.M. tests (not modified) gave too high results. The flame test gave incorrect results in most cases. The standard formula relating the volatile matter of vitrain to its ultimate analysis is not applicable to coals containing large amounts of waxes, resins or algae (indicated by over 10% H_2), and if applied to such coals the formula gives a positive volatile displacement which indicates the presence of super-hydrous material in coal.

--R.L. Husch

WASTE LIQUORS, PURIFICATION

PURIFICATION OF LIQUOR EFFLUENTS. DISPOSAL OF WASTE LIQUOR. *Fifth Annual Report of the British Gas Research Board, pp. 39-41, (1943-44).*

A study has been made of the removal of higher tar acids from waste liquor in gas plants. Processes depending on the use of solvents for the removal of phenols fail to extract most of the higher tar acids which are more soluble in water than in solvents. The treatment of waste liquor with 10% of its volume of amyl acetate in a counter-current flow resulted in a high degree of purification, removing about 95% of the phenols, 70-80% of the higher tar acids and 100% of the thiosulfates and thiocyanates.

--J.J. Sebastian

WATER GAS - MANUFACTURE

Thau, A., LARGE SCALE WATER GAS PRODUCTION FOR CHEMICAL SYNTHESIS. *Gas Times* 44, 32, 1945 (August 18). Translated from *Oel und Kohle* 38, 589, 617, 685, 721, 749 (1942).

For the manufacture of ammonia a synthesis gas containing hydrogen and nitrogen in the ratio of 3:1 is required while for the production of methanol and liquid fuels a gas consisting of hydrogen and carbon monoxide in the ratio of 2:1 is required. The production of synthesis gas of such required compositions has been achieved in Germany by five distinct systems of gasification processes. The method of supplying the required heat for the endothermic decomposition of steam by carbon has been chosen by the author as the basis of classification. (1) In the first class belong the gas generators, employing coke or brown coal as fuel, which operate with intermittent blast and make cycles, such as

those built by the Bamag and Viag concerns. The Viag generators, however, combine this method of heating with the principle of recirculation. (2) The second group comprises those processes which employ oxygen for the internal supply of heat which makes the operation continuous. The Winkler, Lurgi and Thyssen-Galocsy processes belong in this class. (3) Among the processes using indirect heat transfer, by means of recycling part of the produced gases which had been preheated to the required high temperature in intermittently operated regenerators, belong the Pintsch-Hillebrand, Koppers and Wintershall-Schmalfeld processes. (4) A group employing direct heat transfer by external heating comprises the Bubiag-Didier, Reiche Zeche and Ahrens processes, although in the latter the principle of heat transfer by recirculation is combined with external heating. (5) The last class includes all other methods of heat transfer employed such as heating of the reaction chamber by means of electricity as in the Hole and Stassano processes, the use of highly superheated steam in the Pattenhausen process, the use of molten salt bath proposed by Lichtenberger and Haiser, etc. The gas produced by some of these methods needs further processing with steam, either to convert the excess CO into hydrogen or to decompose the methane into CO and H_2, as is done in the Wild, Gesent, Bamag and Viag processes by means of a catalyst employed, which also removes the organic sulfur compounds. In the Kuhlman, Linde and Padovani processes, the same end is achieved by means of hot surfaces. For the removal of the excess CO_2 the alkazid process, pressure washing with water, or other processes have been used.

--J.J. Sebastian

4. NATURAL GAS

DEHYDRATION

Hull, R. H. GOLETA GAS DEHYDRATION PLANT. *Gas Times* 44, 30-32, 1945 *(August 4)*.

RESERVES

Crowell, A. M. CONSERVATION OF THE NATION'S NATURAL GAS RESERVES. *Natural Gases* 1, 7-10, 1945 *(September)*.

Best evidence of development of effective conservation practices in gas-producing states is that over a period of the past 10 years (1935-45) whereas total marketing and use of natural gas has doubled with rise of only 10% in number of producing wells, recoverable reserves have more than doubled, i.e., while estimated supply of 30 years existed in 1935, on basis of present demand there is a supply for 33 years. Progress of past 15 years in natural gas conservation and efficient production, transportation and utilization exceeds that in balance of 170 year history of industry.

Effective conservation of both gas and oil is problem of producing states, particularly Arkansas, Kansas, Louisiana, Oklahoma and Texas in which 82% of the nation's natural gas reserves are estimated to be; where, by actual practice, they have demonstrated their ability to affect a workable conservation program from the economic, legal and engineering viewpoint.
--Excerpt from Author's Abstract

RESERVES

DeGolyer, E. PROVED GAS RESERVES AND PROSPECTS. *Gas Age* 96, 24, 1945 *(October 4)*.

The statistics given are broken down by state and district.

They were presented September 18 before the Federal Power Commission hearings on the natural gas industry, Kansas City, Mo.

RESERVES

Fagin, K. M. REVIEW OF MAJOR U. S. GAS PRODUCING FIELDS. *Petroleum Eng.* 16, 226, 228, 230, 232, 234, 1945 *(September)*.

The nation's natural gas reserve is about 165 trillion cu. ft. of which about one-half is situated in 19 states. Figures are given for reserves by states and sources. A bibliography is included.

RESERVES

NATURAL GAS. *Oil Gas J.* 44, 167, 1945 *(October 20)*.

The Natural Gas Department of American Gas Association has established a committee on natural-gas reserves, whose function will be to prepare and maintain estimates of the country's reserves of natural gas. R. H. Hargrove, chairman of the Natural Gas Department, says it is planned to

have the work of the committee correlated with that of the American Petroleum Institute's committee on oil reserves so that there may be an interchange of information and findings.

--Excerpt from article

STORAGE

Todd, R. W. LA GOLETA NATURAL GAS STORAGE PROJECT. *Calif. Oil World* 38, 23-28, *1945 (September); Oil Weekly* 119, 49-51, *1945 (September 24).*

USES

Fullerton, F. H. CANADIAN GREENHOUSES ARE HEATED BY GAS. *Industrial Gases* 24, 22, *1945 (October).*

Natural gas is used to help nature in the production of cut flowers for Dominion-wide distribution out of season at Medicine Hat, Alberta. Here six large greenhouses covering more than sixteen acres, with an annual production valued at $500,000, are operated. In addition to six large units there are a number of smaller greenhouses.

--Excerpt from article

5. FUELS AND COMBUSTION

GASES - COMBUSTION

Vandaveer, F. E. and Segeler, C. G., PARTIAL COMBUSTION OF GAS WITH DEFICIENCY OF AIR. *Ind. Eng. Chem.* 37, *816-820, 1945 (September).*

While the chemical effect of the combustion products of gases used as industrial fuels can be disregarded in many manufacturing processes, there are numerous fields, such as metals and ceramics, in which the chemical nature of these flue products and their actions upon the materials treated are of extreme importance. The partial combustion of natural, coke-oven,and butane gases has been studied by varying the supply of air from 100% to 10% of the amount required for total combustion. Limits have been established below which external heat must be applied in order to sustain combustion. Natural gas has a limit of 65%; butane, a limit of 60%; coke oven gas, 53%. Ratios of $CO-CO_2$ and $CO-H_2$ are shown for these gases as the combustion reaction proceeds with decreasing amounts of air. Intermediate constituents of the partial combustion, such as aldehydes and other hydroxylated hydrocarbons, and methods of their quantitative determination are given. Formaldehyde was found to be the principal constituent of the partial combustion of gases.

--Robert L. Husch

HEATING VALUE

Schuster, F. INCREASING THE HEATING VALUE OF FUEL GASES BY CONVERSION TO METHANE, *Gas- u. Wasserfach* 87, *No. 2, 52-3 (February 1944).*

No experimental work is presented, but equations are derived for the change in heating value and volume of the gas after CH_4 conversion. These equations are used in the construction of a graph which permits these changes to be easily determined.

--C.A. 39, 4213, 1945 (September 20)

PETROLEUM SUBSTITUTES

Bridgwater, R. M. BRITISH RESEARCH ON PETROLEUM SUBSTITUTES. *Petroleum* 8, *179, 1945 (September).*

Methane can be considered as a petroleum substitute for internal combustion engine fuel. It occurs naturally in Britain along with coal and oil; sewage gas is another indigenous source. Of greater interest is the use of coal as a raw material. Coal is converted to mixtures of carbon monoxide and hydrogen; passage of such mixtures over catalysts produces methane. Up to 1940 the synthesis of methane was far from being commercial because of difficulties occasioned by carbon deposition and poisoning of the active nickel catalysts by sulfur compounds. It is stated that considerable progress has been made since that time.

--C.H. Riesz

6. PETROLEUM

PETROLEUM REFINING

Willson, C. O. PRODUCTS OF INDUSTRY'S LARGE MANUFACTURING UNIT HAVE MOST WIDESPREAD DISTRIBUTION. *Oil Gas J.* 44, 86-90, 1945 (October 13).

A discussion of worlds largest petroleum refinery, Anglo-Iranian Oil Company at Abadan in Iran.

PETROLEUM REFINING - CATALYTIC CRACKING

Larin, A. Ya. CRACKING OF HEAVY PETROLEUM STOCKS OVER HEATED SURFACES. *Bull. de l'Academie des Sciences de l'URSS, Classe de Sciences Techniques* 1944, 42-7.

Various petroleum stocks were cracked with the aid of electrically heated metal spirals to form gases high in olefin content. Cracking of paraffin wax gave the highest yields of gas. Over a nichrome spiral the yields varied from 69-80 per cent according to the current used. Composition of gas was: olefins, 45-78 per cent; paraffins, 25-8 per cent and hydrogen 6-8 per cent. Liquid products amounted to 31-19 per cent while 0.5-1.0 per cent of carbon was found. An oil distillate consisting mainly of naphthenes and one containing up to 21 per cent aromatics produced one half and one quarter, respectively, of the gas yield obtainable from paraffin wax.

--C.H. Riesz

PETROLEUM REFINING - FLUID CATALYTIC CRACKING

Murphree, E. V., Brown, C. L., Gohr, E. J., Jahnig, C. E., Martin, H. Z., and Tyson, C. W. IMPROVED FLUID PROCESS FOR CATALYTIC CRACKING. *Petroleum Eng.* 16, 176, 179-180, 182, 184, 186, 188, 1945 (September).

The abstract of this article which appeared in *Gas Abstracts* 1, No. 1, 16 1945 (Apr.) is as follows: The new down-flow type of reaction system is described for the first time. Details of plant design, yields, and operating results are given for the standard fluid catalyst cracking unit, of which 32 have been built in the last three years.

--G.D. Creelman

PETROLEUM REFINING - THERMOFOR CATALYTIC CRACKING

Kelley, A. E. MEASUREMENT OF SOLIDS IN TCC PROCESS. *Petroleum Refiner* 24, 338-341, 1945 (September).

In the TCC process the catalyst is in the form of round beads or pellets. These flow by gravity to the reactors and to regenerating kilns while fouled catalyst from the reactors and regenerated catalyst from kiln are brought to appropriate heights by a kiln and a reactor elevator, respectively. Flows at various parts of the system are controlled either by piston operated butterfly valves or by flow orifice plates. Provision is made for controlling inert gas and steam seals and to present pressure surges from blowing catalyst and oil vapors back into the reactor feed hopper. A device for continuously indicating the height of solids in feed hoppers is described.

--C.H. Riesz

6. PETROLEUM

PETROLEUM REFINING - THERMOFOR CATALYTIC CRACKING

Noll, H. D. and Bowles, V. O. SMALL SCALE CATALYTIC CRACKING. *Petroleum Refiner* 24, 373-380, 1945 (October); *Natl. Petroleum News* 37, 767-771, 1945 (October 3).

Designs of small T.C.C. units have been completed and units of 2000-3000 bbls./day are now available for the small refiner to meet the demand for higher octane gasoline. The expected earnings from catalytic cracking units at a given octane level are in nearly every case sufficiently greater than for thermal cracking to justify their installation, and reduction in yield of residual fuel makes for greater flexibility in meeting many local market conditions. Existing thermal equipment may be adapted to form part of the catalytic installation. The article contains 10 tables and 7 graphs of process and economic data, a similified flow diagram and isometric sketch of the proposed unit.

--L.A. Mekler

SYNTHETIC CHEMICALS

Smith, S. F. SYNTHETIC CHEMICALS FROM PETROLEUM. *Petroleum* 8, 184-185, 1945 (October).

The first instalment in this series (p. 163) introduced an abridged version of Sir Frank Smith's Cantor lecture delivered before the Royal Society of Arts, specially prepared for the readers of this journal. Previous Cantor lectures were reviewed, the petroleum chemical industries discussed, and petroleum hydrocarbons characterised. The current issue deals with synthetic fuels, engine development, molecular and polar forces, action of double bonds, change of state: gas to solid. In instalments to follow will be discussed dielectrics, natural and synthetic rubbers, petroleum-derived chemicals, thermoplastic and thermosetting materials, polymers, copolymers, and condensation polymers.

--Author's Abstract

7. ANALYTICAL METHODS AND TESTS

CYCLOPROPANE - PROPYLENE MIXTURES

Corner, E. S. and Pease, R. N., ANALYSIS OF CYCLOPROPANE-PROPYLENE MIXTURES BY SELECTIVE HYDROGENATION. *Ind. Eng. Chem. Anal. Ed.* 17, 564-565, 1945 *(September)*.

A method for analyzing mixtures of cyclopropane and propylene by selective hydrogenation is presented. The method consists in passing the mixture at 150° C with purified hydrogen over a nickel-kieselguhr catalyst which is partially poisoned with mercury to hydrogenate the olefin. After this determination the cyclopropane in the remaining sample is hydrogenated over non-poisoned nickel-kieselguhr catalyst at the same temperature. Adsorption effects are eliminated by use of a small amount of catalyst (2-3 cc.) and by evacuation of the catalyst chambers with a Toepler pump after each determination. Inert components such as gaseous paraffins do not interfere with the analysis. Samples (about 1 cc.) may be analyzed with good accuracy where as larger samples may be determined with an accuracy of ± 0.5 numerical per cent.

--C.H. Riesz

GASES - ANALYSES

Rubin, L. C. and Solomen, E. MASS SPECTROMETRIC GAS ANALYSIS. *Amer. Gas Assoc. Monthly* 27, 461-463, 1945 *(October)*.

An article wherein the use and structure of the mass spectrometer, an instrument for the analysis of fixed gas and hydrocarbon mixtures, is described. The gas to be analyzed is bombarded with electrons from a filament source. This results in positively charged ions which are made to follow a given path at a controlled rate of velocity and in a calculable magnetic field. These are then passed through a slit of proper radius and caused to impinge on a target whose circuit is amplified and recorded by a galvanometer whose deflection is proportional to the abundance of ions, yielding a mass spectrum which can be broken down into individual component spectra. Representative analyses are presented. The speed and accuracy of the method are compared with other methods, the major advantage being a complete analysis with internal checks on accuracy and a check on unsuspected components with lower costs per analysis. It has been reported that it is possible to run 800 analyses with this unit in a single month.

--B. Grimm

GASES - ANALYSES

Sneddon, R. THE MASS SPECTROMETER GRADUATES. *Petroleum Eng*, 16, 148, 150, 152, 1945 *(September)*.

The mass spectrometer has been used with satisfactory results for routine testing of a wide range of hydrocarbon mixtures, such as dry gas; wet gas; n-butane and iso-butane; C_1 through C_4 paraffins and olefins; C_3 through C_5 paraffins and olefins; C_4 paraffins and olefins; C_5 paraffins, olefins, diolefins and cyclics; C_5 through C_6 paraffins, cyclics, and aromatics; C_7 paraffins; C_8 paraffins; determination of benzene, toluene and xylenes in gasoline; determination of small amounts of diethylbenzene

7. ANALYTICAL METHODS AND TESTS

In ethyl benzene. The mass spectrometer functions by ionizing the molecules in complex gas mixtures and then segregating them in individual streams according to their mass. Advantages claimed for the apparatus are accuracy, sensitivity, simplicity of operation, and speed.

HEXANES, ISOMERIC

Miller, V.A., TERNARY MIXTURES OF THREE ISOMERIC HEXANES. *Ind. Eng. Chem. Anal. Ed.* 17, 566-567, 1945 (September).

It is not readily possible to separate by fractional distillation alone, the ternary hexane mixtures composed of 2,2 dimethylbutane, 2,3-dimethylbutane and 2-methylpentane. A method is presented in which solution temperatures in both nitrobenzene and diethyl phthalate determine the composition uniquely by means of three calibration curves and a triangular plot. The analysis takes about one hour and is accurate to 0.5%. Details of the method were described previously. (Miller, *Ind. Eng. Chem. Anal. Ed.* 17, 5-12 (1945).

--C.H. Riesz

SPECTROSCOPY

Gill, F. SPECTROSCOPIC ANALYSIS IN THE PETROLEUM INDUSTRY (I). *Petroleum* 8, 186-187, 1945 (October).

The fundamentals of the spectrum and of emission and absorption spectra (both infra-red and ultraviolet) are explained. The practical application in the petroleum industry of ultraviolet and infra-red absorption to the analysis of hydrocarbon mixtures is indicated, and the advantages of spectroscopic methods for rapid plant control are stressed. The Raman effect is discussed briefly, although the long exposure times militate against its use in industry.

The principle of the mass spectrograph is included for completeness, since this instrument is usually classified as spectrograph apparatus, although it is strictly a mass analyser. In the second part of this article will be discussed another method of ultraviolet absorption, infra-red methods and apparatus, general procedure of the analysis of mixtures, Raman effect (apparatus and application), and the mass spectorgraph.

--Author's Abstract

SULFUR, MERCAPTAN

Dittrich, E. DETERMINATION OF MERCAPTAN SULPHUR IN CALORIMETRIC BOMB. *Petroleum Refiner* 24, 109-110 1945 (June).

This article is a translation from *Brenn-Chemmie* 20, 348 (1939). A calorimetric bomb technique is described for the determination of low molecular weight aliphatic mercaptans in oils. Data presented indicate that an initial oxygen pressure of at least 35 atmospheres is necessary to quantitatively recover mercaptan sulfur from oils containing up to 5% mercaptan sulfur.

--E.A. Knaggs

8. GENERAL AND PHYSICAL CHEMISTRY

CARBON BLACK

Emmett, P. H. and Anderson, R. B. THE ADSORPTION OF WATER VAPOR ON CARBON BLACK. *J. Am. Chem. Soc.* 67, 1492-1493, 1945 *(September)*.

Evacuating two typical carbon blacks at 1000 to 1200° C resulted in slight differences in nitrogen adsorption isotherms. However, the nitrogen adsorption isotherms before and after evacuating showed that the samples did not develop porosity and did not increase their surface areas.

--S.W. Martin

CARBON DIOXIDE

Mills, J. R., and Miller, F. J. L., LIQUEFACTION OF CARBON DIOXIDE. *Can. Chem. & Process Ind.* 29, 651-653, 1945 *(September)*.

Phase studies for the binary systems CO_2-N_2 and CO_2-H_2 are related.

--J.D. Parent

GASES - SPECIFIC HEATS

Geyer, E. W. SPECIFIC HEATS AND ENERGY CHARTS FOR GASES. *Engineering* 159, 381-3, 423-4 (1945).

The entropies of the gases N_2, O_2, CO_2, and H_2O are calculated and tabulated in B.t.u. per lb. mol. per deg. F. over the temp. range of 400° F. abs. to 5400° F. abs. in 100° F. intervals. The entropies of the gases at 400° F. abs. are taken as zero. The internal energies of the gases N_2, O_2, CO_2, and H_2O are calculated and tabulated in B.t.u. per lb. mol. over the temp. range of 0 to 5400° F. abs. in 100° F. intervals. The use of the temp-entropy and pressure-volume charts for the determination of the efficiencies of various cycles is illustrated.

--C.A. 39, 4000, 1945 (September 20)

HYDROCARBONS - PHYSICAL CONSTANTS

N.G.A.A. STANDARD TABLE OF PHYSICAL CONSTANTS FOR PARAFFIN HYDROCARBONS. *Oil Gas J.* 44, 115-116, 1945 *(October 13)*.

Authoritative values for the physical properties of hydrocarbons commonly occurring in the natural gasoline range are presented in a condensed table.

--C.H. Riesz

HYDROGEN - MANUFACTURE

Reed, R. M. THE COMMERCIAL PRODUCTION OF PURE HYDROGEN FROM HYDROCARBONS AND STEAM. *Trans. Amer. Inst. Chem. Eng.* 41, 453-62, 1945 *(August)*.

A commercial plant has recently been placed in operation which produces hydrogen of 99.9% purity. For this purpose propane is desulfurized and reacted with steam in two stages, after which the crude hydrogen is cooled and the CO_2 removed by scrubbing with monoethanolamine solution. Both of these reactions are endothermic and are carried out at temperatures of 1400° - 1800° F in the presence of catalysts. Large scale

commercial developments have been carried out by the Standard Oil Company of New Jersey, working with the I. G. Farbenindustrie, and several plants have been constructed which produce from 9,000,000 to 13,000,000 cu. ft. of hydrogen per day using natural gas as the raw material. Several interesting tables are included, among which are: the equilibrium compositions in the Methane-Steam Reaction, the heats of reaction for propane and steam which tabulates the ΔH_s for the reactions $C_3H_8 + 3H_2O = 3CO + 7H$ and $C_3H_8 + 6H_2O = 3CO_2 + 10H_2$ for temperatures from 1340°-1800° F, the water gas constant $K = \frac{(CO)(H_2O)}{(CO_2)(H_2)}$ for temperatures from 260° to 932° F, and material and utility requirements for 1000 SCF of hydrogen. The catalysts used are rugged and long-lived and the replacement costs and labor requirements small. The plant is economically run and production rates of pure hydrogen are high.

--L.H. McEwen

MEMBRANES

Sollner, K. THE PHYSICAL CHEMISTRY OF MEMBRANES WITH PARTICULAR REFERENCE TO THE ELECTRICAL BEHAVIOR OF MEMBRANES OF POROUS CHARACTOR. I. *J. Phys. Chem.* 42, 47-67, 1945 *(March)*.

Membranes are defined and classified. Methods are given for the preparation of collodion membranes possessing a high degree of electro-chemical activity, and experimental techniques for their evaluation are outlined. Electro-negative (cation-active) membranes are more readily prepared and are more selective than the electro-positive (anion-active) membranes. When employed as the separating membrane in a concentration cell, an E.M.F. closely approaching the theoretical is obtained. 30 references.

--A.J. Rudnitzki

MEMBRANES

Sollner, K. PHYSICAL CHEMISTRY OF MEMBRANES. PT. II. *J. Phys. Chem.* 49, 171-191, 1945 *(May)*.

The discussion of the physical chemical properties of membranes is continued in this second paper in a series. Particular attention is directed toward the experimental appraisal of existing theories. 20 references.

--A.J. Rudnitzki

9. ORGANIC CHEMISTRY

ACETYLENE - HYDROGENATION

Sheridan, J. THE METAL-CATALYSED REACTION BETWEEN ACETYLENE AND HYDROGEN. PART V. REACTION OVER PALLADIUM, IRON, AND SOME OTHER CATALYSTS. *J. Chem. Soc.* 1945, 470-476, *(July)*.

The kinetic study of the hydrogenation of acetylene was continued with palladium catalysts supported on pumice. Generally speaking, the activity of the catalyst resembles very much that of the platinum catalyst, and since similarity was also observed in reactions over nickel, palladium, platinum, iron and probably cobalt, it is suggested that the mechanism of reaction is of this type with all catalysts mentioned. Three crystal lattices have been found to be active, which makes comparison rather difficult. However, all face-centered cubic metals, nickel, palladium and platinum showed enhanced activity.

--F. Lister

CATALYSTS

Foster, A. L. REFINING TECHNOLOGY GOES CATALYTIC. *Oil Gas J.* 44, 133-135, 137-140, 1945 *(August 25)*.

Catalysis has become an important factor in the manufacture of various products from petroleum and natural gas. This is the first of a series of articles presenting most of the catalysts and catalyst compositions which have been disclosed. This article discusses catalysts for catalytic cracking and reforming, mainly on the basis of the patent literature. 115 references (of which 111 are patents).

--C.H. Riesz

CATALYSTS

Foster, A. L. CATALYSTS EMPLOYED IN HYDROCARBON ALKYLATION REACTIONS. *Oil Gas J.* 44, 89, 91, 93, 1945 *(September 8)*.

This is the second article in a series on catalytic refining technology. The discussion is based mainly on patent literature. Anhydrous hydrogen fluoride, boron fluoride, sulfuric acid, phosphoric acid and gallium chloride in various form and with various promoters are disclosed as catalysts for hydrocarbon alkylation reactions. 46 references (of which 43 are patents).

--C.H. Riesz

CATALYSTS

Foster, L. POLYMERIZATION AND ISOMERIZATION ARE EFFECTIVE IN MOTOR-FUEL MANUFACTURE. *Oil Gas J.* 44, 103, 107, 1945 *(September 29)*.

This is the third article of a series on catalysts in petroleum technology and deals with catalysts for polymerization and isomerization. Phosphoric acid in various forms and combined with certain metals, such as copper, is widely used for polymerization. For isomerization of

hydrocarbons, aluminum chloride in various forms is in wide commercial usage. Discussion is based on a bibliography of 82 references of which 79 are patents.

--C.H. Riesz

CATALYSTS

Foster, A. L. HYDROGENATION-DEHYDROGENATION, AROMATIZATION CATALYSTS IMPORTANT TO REFINING TECHNOLOGY. *Oil Gas J.* 44, 109-113, 1945 (October 13).

This the fourth in a series of articles on catalysts in petroleum technology. For dehydrogenation, the oxides of chromium, vanadium or molybdenum supported on a carrier such as alumina are widely used. Aromatization and cyclization is effected by the same or similar catalysts. For hydrogenation, reduced nickel, platinum or copper is supported on a carrier such as kieselguhr or pumice. The discussion is based almost entirely on patents. 121 references.

--C.H. Riesz

HYDROCARBONS - ALKYLATION

Linn, C. B. and Grosse, A. V. ALKYLATION OF ISOPARAFFINS BY OLEFINS IN PRESENCE OF HYDROGEN FLUORIDE. *Ind. Eng. Chem.* 37, 924-929, 1945 (October).

Anhydrous hydrogen fluoride catalyzes the interaction of olefins and isoparaffins to form saturated, highly branched paraffinic hydrocarbons suitable for aviation gasoline. Continuous and batch experiments in laboratory apparatus are described. The reaction takes place over a wide range of temperatures but can be done suitably at 10° C. Hydrogen fluoride has a boiling point of 19.4° C and liquid phase reaction is employed; a ratio of one volume of acid to one volume of hydrocarbon in the reactor gives satisfactory results. As ratios of isobutane to butylene increased above 1.5 more selective results were obtained. Runs are described involving the paraffins isobutane and isopentane and the olefins, propene, isobutene, 1-butene and 2-butene as well as a commercial butane-butene fraction. A small amount of fluorine which must be removed remains in the alkylate.

--C.H. Riesz

HYDROCARBONS - ALKYLATION

Schmerling, L. THE MECHANISM OF THE ALKYLATION OF PARAFFINS. *J. Amer. Chem. Soc.* 67, 1778-1783, 1945 (October).

In an introductory discussion are presented previously proposed mechanisms of alkylation in the presence of an aluminum trichloride catalyst. After indicating the advantages and disadvantages of such mechanism the author proposes a new mechanism based on a chain reaction. The alkylation reaction of isobutane and ethylene serves as an example and three steps are proposed: (a) chlorination of the isoparaffin and simultaneous hydration of the olefin; (b) addition of the newly formed alkyl halide to the olefin; and (c) dichlorination of isobutane by the high molecular alkyl halide with simultaneous rearrangement of the

alkyl chain. The chlorinated isobutane then reacts again with ethylene. Evidence for all three steps involved in the reaction is cited.

--F. Lister

ISOBUTYLENE - POLYMERIZATION

McKinley, J. B., Stevens, D. R. and Baldwin, W. E. THE CYCLIC DIMERIZATION OF ISOBUTYLENE. *J. Am. Chem. Soc.* 67, *1455-1459, 1945 (September).*

A study of the thermal polymerization of isobutylene showed that a cyclic dimer, 1,1,3 - trimethylcyclopentane, is the main reaction product. A study of reaction variables showed an optimum yield of 23.4 per cent based on the isobutylene charged at 430° C, 2025 psi pressure and a reaction time of one hour. Mechanisms are proposed to explain the formation of the cyclic dimer.

--C.H. Riesz

ISOPENTANE - MANUFACTURE

Galstaun, L. S., ISOPENTANE PRODUCED BY LIQUID PHASE ISOMERIZATION. *Chem. Met. Eng.* 52, *109-111, 1945 (September).*

First commercial plant converting n-pentane into iso-pentane by means of a new process is described. Yields of isopentane are 50-60 per cent on a once-through basis and 97 per cent yield is obtainable on recycling. Catalyst employed is anhydrous aluminum chloride, carried as a solution in molten anhydrous antimony trichloride, together with 5 mole per cent of anhydrous hydrogen chloride. In the process the feed, after being dried, enters a preheater where the temperature is raised to within 20 or 30° of the reaction temperature. The feed then runs to the bottom of the catalyst scrubber column where antimony trichloride and free aluminum chloride are extracted from the reject catalyst stream entering at the top of this column. This pentane stream is passed into the contactor where the temperature is 200° F. and the pressure, 300 lb. per sq. in. Important process control variables are: (1) the temperature of the contactor, (2) concentration of aluminum chloride in the catalyst, (3) concentration of hydrogen chloride, (4) volume of hydrogen recycled to the contactor and (5) the concentration of inert hydrocarbon-aluminum chloride complex in the catalyst.

--M. Miyaji

OLEFINS - CATALYTIC CRACKING

Greensfelder, B. S. and Voge, H. H. CATALYTIC CRACKING OF PURE HYDROCARBONS. *Ind. Eng. Chem.* 37, *983-987, 1945 (October).*

Cracking over a silica-zirconia-alumina catalyst at 350-500° C. of seven aliphatic olefins, two diolefins, two cyclic olefins, and two aromatic olefins was studied. The principal conversions of aliphatic mono-olefins were isomerization, cracking, saturation, and formation of higher boiling materials and coke. Diolefins and aromatic olefins were extensively saturated and transformed to higher-boiling materials and coke. Catalytic

and thermal cracking of olefins at 400-500° C. are compared. The catalyzed reactions, which are of the order of 1,000 to 10,000 times as fast, yield larger fragments, involve much more isomerization, and lead to greater saturation of product.

--Author's Abstract

10. DEVELOPMENT ENGINEERING

POWDER METALLURGY

Hradecky, R., and Seelig, R. P. POWDER METALLURGY PRECISION PARTS. *Iron Age* 156, 50-54, *1945 (September 27)*.

Wartime advances made in powder metallurgy and the postwar possibilities are discussed.

--V.S. de Marchi

HEATING

BASEBOARD HEATING. *Heating & Ventilating* 42, 75-82, *1945 (October)*.

Baseboard heating is another form of room heating, at present used with forced circulation hot water systems. The following articles summarize the available information on this type of heating.

Base-Board Heating-by Finned Copper Tubing.
Baseboard Heating-by Cast Iron Sections
I-B-R Tests of Baseboard Heating.

HEATING, RADIANT

Carne, J. B. THE INFLUENCE OF NATURAL CONVECTION ON THE EFFECTIVENESS OF RADIANT ("INFRA-RED") HEATING. *Gas Times* 44, 57-59, *1945 (September 29); Gas World* 123, 296-303, *1945 (September 29)*.

Attention is drawn to the necessity of considering the convection loss from heated objects during "infra-red" processing. The dependence of the magnitude of this loss on the curvature of the object surface and its relatively greater magnitude for sharply curved objects are pointed out. The results of an experimental investigation of the effect are detailed and shown to confirm deductions from published heat transfer data. Paint processing observations supporting the temperature data obtained are also given. It is concluded that high temperature air is essential to the economic heating of sharply curved objects and to the attainment of uniform temperatures where objects of various curvatures or differing absorbing properties for the radiation employed are heated simultaneously in the same oven. Suggestions as to the form of test objects used in measuring the performance of radiant ("infra-red") ovens are made.

--Author's Abstract

PAINT DRYING

Tesmer, W. H. "TECHNICAL" - "INFRA-RED" PAINT DRYING WITH GAS. *Butane Propane News* 7, 104-110, *1945 (October)*.

REFINING

IMPROVED OPERATING TECHNIQUES IN REFINING WILL ACCRUE FROM ATOMIC BOMB RESEARCH. *Natl. Pet. News.* 37, 836-844, *1945 (October 3)*.

A number of possible industrial applications of the Atomic Bomb Research are listed, but no details are given. The following statement regarding separation of gases may be of some importance: "Barriers for Gas

10. DEVELOPMENT ENGINEERING

Diffusion. An entirely new type was developed and new techniques worked out for diffusional separation of gases. It is believed these may be applied in industry in isolating hydrogen from process gases and ethylene from cracked gas oil. Through its application also, means may be developed for separating natural gasoline fractions from crude oil without resorting to distillation. New types of fractionating columns for petroleum refining may also result, it was said." Details of the press conference held by the M. W. Kellogg Co. are given in the second issue of "Atomic Power" - McGraw Hill (Vol. 1, No. 2, 1-15 (October)).

--G.D. Creelman

II. CHEMICAL ENGINEERING

DISTILLATION

Hepp, H. J. and Smith, D. E. LABORATORY DISTILLATION AT ATMOSPHERIC PRESSURE OF NORMALLY LIQUID HYDROCARBONS. *Ind. Eng. Chem., Anal. Ed.* 17, 579-581, *1945 (September).*

A column is described which has proved useful for distillation of close-boiling liquid hydrocarbon mixtures. Single-turn wire helices are used as a packing, and a specially designed differential thermocuple makes it possible to compensate column heat losses for adiabatic conditions. A solenoid operated distilling head is shown. Columns of the described design containing up to about 100 equivalent plates have been operated satisfactorily.

--C.H. Riesz

DISTILLATION

Perry, C. W. ANALYSIS DETERMINES CONTROL VARIABLES FOR DISTILLATION SYSTEMS. *Chem. Met. Eng.* 52, *108-112, 1945 (October).*

This work is based primarily on the paper of Gilliland and Reed *Ind, Eng. Chem.* 34, *551 1942)* wherein a rigorous analysis is made of the degrees of freedom of multicomponent, multistage systems in terms of the phase rule and the laws of conservation of matter and energy. The author applies this to the operation of distillation systems in an effort to determine the minimum number of automatic, controlling instruments which are required for successful operation.

--J.D. Parent

FLOW METERS

Spink, L. K. CHARACTERISTICS OF THE DIFFERENTIAL TYPE FLOW METER AND CONDITIONS AFFECTING OPERATION. Reprint from *Petroleum Refiner* 23, *433-441; 488-492, 1944 (November, December).*

Operational characteristics of primary devices are related and tabulated. Proper installation procedure is given.

--J.D. Parent

FLUID FLOW

Buthod, P. and Whiteley, B. W. PRACTICAL PETROLEUM ENGINEERING. *Oil Gas J.* 44, *122-124, 1945 (October 20).*

Presented here is the initial installment of a series of a dozen articles on the solution of fluid-flow problems. Dealing with the practical side of fluid flow in pipes and through granular beds, the article discusses present-day methods employed in determining pressure drop. More than 15 charts for the graphical determination of various factors employed in the solution of fluid-flow problems and for the calculation of pressure losses, are included in the series. Unique among the charts is that of Viscosity Correlation for Petroleum Liquids. Covering the wide range of flow problems usually met in the petroleum industry with illustrative examples, the articles explain how the various charts may be used.

II. CHEMICAL ENGINEERING

Outstanding in the series is the overall simplicity of the graphical method of solving otherwise tedious operations. Based upon reliably correlated data, the charts will be found to show surprisingly accurate results in the final solution of many fluid-flow problems.

--Author's Abstract

FLUID FLOW

Dalla Valle, J. M. APPLICATIONS OF FLUID FLOW. *Heating & Ventilating* 42, 86-100, 1945 (October).

This is the second and final part of a treatment on fluid flow problems. The first section reported in the April issue treated the fundamentals of fluid flow. This present section covers applications. Head losses in channels and fittings and heat losses from pipe are reported.

--J. D. Parent

HEAT FLOW

Vanderweil, R. G. HEAT FLOW IN PANEL-HEATED ROOMS. *Heating and Ventilating* 42, 102-110, 1945 (October).

Readers who have followed the discussion of various radiant heating problems in previous articles of this series by Mr. Vanderweil may have been looking for information on the relationships between such variables as panel temperature, unheated wall temperatures, wall heat loss, air temperature, and loss by ventilation. In the accompanying article the author shows these correlations, explains the heat balance, develops its theory, and concludes with a simple graphical method of determining temperatures and heat quantities for a typical room.

--Author's Abstract

ORIFICE METER COEFFICIENTS

Forster, G. H., Jr, CALCULATION OF ORIFICE METER COEFFICIENTS FOR NATURAL GAS. *Petroleum Refiner* 24, 114-115, 1945 (August).

PRODUCER GAS - THERMODYNAMICS

Oleson, A. P. and Wiebe, R. THERMODYNAMICS OF PRODUCER GAS COMBUSTION. APPLICATION TO INTERNAL COMBUSTION ENGINES. *Ind. Eng. Chem.* 37, 653-660 1945 (July).

The composition and heats of combustion of producer gas derived from various raw materials are given. A nomograph is presented for calculating the heats of combustion of producer gas mixtures containing hydrogen, carbon monoxide, and methane. The theoretical air-fuel ratios of producer gas are compared with those of other fuels used in internal combustion engines, and attention is called to their importance in connection with carburetor design. The heat of combustion of a mixture of producer gas with theoretical air is considerably lower than that of gasoline or alcohol; and lower power output must be expected from such a mixture run under identical conditions with the liquid fuels mentioned above. The

thermodynamic properties of two typical producer gas mixtures are calculated, and the results shown on charts. A sample calculation gives temperatures and pressures at various points of the Otto cycle, as well as work, mean effective pressure, and efficiency. The effects of compression ratio and intake-manifold pressure on mean effective pressure and thermal efficiency are shown by charts. It is pointed out that extreme compression ratios are not so practicable for an Otto cycle engine as an increase in manifold pressure, since a relatively low supercharge pressure gives a power output equivalent to that of gasoline. It would be possible to use such a fuel in a Diesel gas engine.

--Author's Abstract

12. APPARATUS AND EQUIPMENT

FURNACES

Cook, E. E. TEMPERATURE CONTROL OF HEAT-TREATMENT FURNACES. *Inst. Fuel War Time Bull.* 18, 237-251, *1945 (August).*

A review of the various types of temperature controls available for heat treatment furnaces. The limitations of each type and the correct form of control to use for various duties are discussed.

--V.S. de Marchi

PICKLING TANKS

Hoffmann, A. M. SUBMERGED AIR-GAS BURNER FOR PICKLING TANKS. *Industrial Gas* 24, 13-14, *1945 (September).*

The unit consists of an L-shaped tubular chamber made of various metals to resist specific acids. One section enters the tank and houses gas and air pipes, a burner plate, and an igniter. The other arm runs along the bottom and is provided with exhaust ports. Experience has shown that: (a) in the case of open jet steam heating the loss is high because the steam condensation weakens the solution, (b) the fumes from the open tank heated by the closed steam system carry twice as much acid as those from a (c) direct-fired tank. When using natural gas at 20 cents per million Btu and using submerged burners in place of steam heating, saving in heating cost of as much as 33.5 cents per ton of metal pickled are reported.

--V.S. de Marchi

13. NEW BOOKS

Amer. Gas Association, ANNUAL STATISTICS OF THE NATURAL GAS UTILITY INDUSTRY IN 1944. *Statistical Bull. No. 59, 1945 (October).*

Baker, J. R. SCIENCE AND THE PLANNED STATE. *New York, MacMillan Co., 1945.*

Ledoux, E. VAPOR ADSORPTION. Brooklyn, *New York, Chemical Publishing Co., Inc. 1945.*

This covers a detailed study of the theoretical principles of static and dynamic adsorption. The last section of the text is devoted to some industrial applications such as gas drying and vapor recovery.

--J.D. Parent

Univ. of Texas. TEXAS LOOKS AHEAD. VOL. I. THE RESOURCES OF TEXAS. *Austin, Texas, Univ. of Texas, 1944.*

Amer. Gas Association. ANNUAL STATISTICS OF THE MANUFACTURED GAS UTILITY INDUSTRY IN 1944. *Statistical Bull. No. 58, 1945, (October).*

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